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the valuable series of Romanes. Throughout it is conservative, perhaps ultra-conservative in its treatment of such topics as the biogenetic law, the heritability of modifications, and some other general subjects. And it is thoroughly orthodox; the giraffe and the black-smith are not found wanting.

The entire American Museum of Natural History would be required adequately to illustrate so inclusive a theme as this. And the complete absence of figures, which were abundantly provided for the lectures themselves, is a serious defect. The capacity, even of the careful reader, for misunderstanding language, is enormous. Even a few well-selected figures would give the reader a frequent sense of definite concreteness which is occasionally lacking in some of the passages dealing with the facts of evolution.

There is no index.

It is safe to say that this book will prove immensely useful, and its use will not be limited to the unscientific. Students of biology and sociology will find it a valuable aid and summary. In marked and agreeable contrast to Romanes's work, it is entirely free from controversial tone, and its excellent spirit, so well evidenced by the concluding chapters, will go far toward making the doctrine of evolution completely acceptable to those who still persist in exempting from evolutionary treatment and understanding, certain large and important fields of human action and thought.

W. E. KELLCOTT

Guayule, a Rubber Plant of the Chihuahuan Desert. By F. E. LLOYD. Carnegie Institution of Washington, Publication No. 139. 1911. Pp. viii + 213. Plates 46, text figures 20.

It is seldom that the results of a critical study of one plant from several different viewpoints are brought together at one time within the covers of a single book. The author of Guayule has, however, collected many facts relating to the growth and utilization of *Parthenium argentatum* Gray, which are worthy of notice. The interest in the present work from the scientific standpoint is en-

hanced by the fact that the subject of the investigations is a native of desert regions relatively little known botanically or ecologically. From the economic standpoint it is of interest as furnishing a record of a plant of peculiar importance commercially, whose life history and habits were hitherto practically unknown, though subjects of abundant speculation and conjecture.

The first chapter presents a brief historical account of the Guayule and its use. The writer traces the development of the industry and describes some of the methods of extraction, which in this case are based upon the fact that the rubber is not produced in latex which issues from incisions in the bark, but is obtained only upon trituration of the stem, branches and roots of the plant. Involving, as it does, the immediate destruction of the whole plant, the manufacture of Guayule rubber is attended by the prospect of an early depletion of the natural supply. Hence investigations were begun looking to the placing of the enterprise upon a permanent footing.

The environment of Guayule and its biotic relations are discussed in the second chapter. *Parthenium argentatum* is distributed widely over the Mexican plateau and on hills whose soil is chiefly of limestone origin. Its altitudinal distribution is from 2,000 to 10,000 feet, though mostly from 5,000 to 6,000. The local distribution of the plants and the extent of their numerical development were carefully studied by the author, who is unable, however, to explain the almost total absence of Guayule in the alluvial soil of the broad playas. He suggests that this fact may be due to the meager aeration of the soil of the playa, and to the possibility of a slight acidity, owing to the presence of a slight quantity of humus. The reviewer has obtained results¹ that seem to show that the mechanical conditions of a fine alluvial soil are not unfavorable to the growth of Guayule. But on the other hand it should be noted that the quantity of water-soluble salts is less in

¹ *American Review of Tropical Agriculture*, May-June, 1910.

the native soil of the Guayule than in the alluvium of the garden, where the experimental grounds were located, which resembles the soil of the playa. It would, moreover, seem unlikely that acidity exists in this soil in the presence of carbonates. At all events the greater concentration of the salt solutions in the soils of the lower plain, as a possible additional factor affecting the distribution of Guayule, is well worth consideration. This conclusion is supported by the fact that the alluvial soil proved inimical to the growth of seedlings, a fact which Professor Lloyd elsewhere recognizes, and that this was not due to mechanical conditions alone has been demonstrated in carefully conducted experiments.¹ Some of the alluvial soil used was fatal to the Guayule seedlings at first, but after leaching offered no obstacle to their development (page 68), additional evidence that the salt content is in this case an important factor.

Discussing the subject of the size and form of the Guayule plant, the author states the upper limit of weight to be about 5 kilos and of height to be about one meter. The mature plants are profusely branched, the leaves and younger twigs being clothed with a silvery pubescence. The root-system, distributed chiefly through the superficial layers of the soil, is partly concerned with the usual work of absorption and partly with the function of vegetative reproduction, accomplished by long, slender members from which arise shoots called *retoños*. The identification of two biotypes is a matter of special interest. As to whether there were two distinct forms of the Guayule was a subject frequently discussed at Cedros. Observers sometimes remarked two forms of the plant, yet when an effort was made to delimit the characters of the two forms definitely, their distinctive marks seemed quite elusive. It would seem that the author of the present paper has happily discovered the line of cleavage.

Under the topic of reproduction the function and importance of the *retoño* is discussed at length. As a means of reproducing a stand of Guayule the *retoño* is not found to be very effective. Regeneration of the stand

is brought about much more rapidly by cutting off the shrub instead of pulling it up in the harvesting process. Reproduction by seed is slow and only takes place at all on open ground under the most favorable conditions. The author concludes that a ten to fifteen year rotation is practically possible and economically advantageous, the average rate of height growth being about 3 cm. per annum.

The chapters on the anatomy of the plant (V. and VI.) present a detailed description of the structure of the young and mature plants in root, stem and leaf. In this connection it is interesting to note the effect of irrigation on the relative development of wood and bark. The volume ratio of bark to wood in the irrigated plant is near to unity in the smaller twigs to 0.27 in the larger, up to 13 mm. in diameter. In field plants the ratio for the smaller twigs approaches 2.5, being reduced to 1.7 for stems 13 mm. in diameter and approaching unity in those larger. On the other hand, in point of age the ratio of total bark produced in the irrigated plant to that of the field plant of the same age is about 5.6.

On the origin and occurrence of rubber (chapter VII.) the author informs us that 9.5 per cent. of the dry weight of the shrub is rubber. This is distributed through the pith, medullary rays and inner bark. The quantity of the rubber secreted and the time of secretion stands in relation to the water available and the seasonal activity of growth. Very little rubber is secreted during the period of active growth, and relatively little at any time in irrigated plants, but secretion proceeds more rapidly with the advance of the dry season. The function of the rubber in the economy of the plant seems obscure.

The concluding chapters deal with the experimental operation on vegetative reproduction, with seeding, and with proposed methods of cultivation. The author takes a hopeful view of the possibilities, and believes the solution of the problem of successful propagation not to be beyond the limits of practicability. From the evidence adduced it would seem that this may be possible, but the evidence also seems to point to the conclusion that an ade-

quate conservation policy with reference to the harvesting of the native crop is immediately imperative, and that it will also doubtless avail more for the perpetuity of this resource than any attempts at plantation methods.

It is to be regretted that the author has not considered in this connection the cost of the operations, upon which must depend, of course, the practicability of propagation. Since field seeding seems impracticable, except under the most extraordinary conditions, the procedure must take the form of nursery methods, involving considerable outlay in labor and equipment. Without discussing the details, for which space can not be taken here, it may suffice to say that the cost involved in these operations, computed on the basis of conditions at Cedros, seems quite prohibitive.

In conclusion, the admirable quality of this contribution should be recognized. Though lacking completeness in parts, as the author himself admits, there are in this work, nevertheless, the abundant results of careful and painstaking research. The magnitude of the accomplishment is the more apparent to the reviewer, as one familiar with the difficulties and discouragements which beset its author during the year upon the hacienda.

J. E. KIRKWOOD

Les syénites néphéliniques de l'Archipel de Los et leurs minéraux. By A. LACROIX. Extrait des nouvelles archives du Museum, Series 5, Vol. III. Paris. 1911. 4to. Pp. 132, 10 plates and text illustrations.

In any work from the fertile pen of M. A. Lacroix we are accustomed to expect the thoroughness and accuracy that distinguish the present petrographic study on the nephelinic syenites of the Isles of Los off the coast of Guinea. This group of islands was ceded to France by the Anglo-French convocation of 1904.

M. Lacroix signalizes the interesting fact that the geological formations of the Guinea coast differ radically in their chemical composition from those of the nearby Isles of Los (p. 8). In the nephelinic syenites constituting Rouma (Crawford) Island, lavenite and

astrophyllite are constant constituents, often present in as great quantity as ægyrite, all being distinguishable without the aid of the microscope; sometimes one and sometimes the other of these constituent minerals predominating. When these rocks contain arfvedsonite, occasionally accompanied by a little biotite, this amphibole forms crystals which may attain a length of several centimeters. In addition to the elements above noted, villiamite may also be found as well as fluorite and pyrochlore, both in microscopic quantities; more rarely eudialite is observable. To them may be added several secondary minerals. The author finds in the fact that the lavenite is often formed after the feldspars a typical quality of these rocks, this constituent being usually a primitive constituent in rocks of this kind, although analogous conditions have been observed in nephelinic syenite from the Ord Range in Texas.

The syenites of the Isles of Los are divided by the author into the principal petrographic groups, whose close relation to one another is brought out by chemical examination. One of them, more alkaline and containing little or no lime or magnesia, is constituted by the syenites with ægyrite; the other, but a trifle more calciferous, includes the syenites with black amphibole and augite, and the alkaline monzonites where plagioclase exists.

The characteristics of these two groups and those of the minerals found in the syenites are very fully described. Among the minerals found in the first group are the following: feldspars, either sodium orthoclase (Rouma, Kassa), or microcline (Rouma, Robané); they especially abound in the pegmatites of Rouma; nepheline occasionally occurring in crystals five centimeters in length; sodalite, a light yellow shade of this mineral, abounds in the normal syenite of Rouma Island; in the pegmatites the soldalite occurs in crystals three centimeters long and of a light yellow, or a lavender blue color, greenish in places, ægyrite-acmite; the ægyrite sometimes approaches to acmite, while in some specimens of syenite from the northern part of Kassa Island only acmite is found; asfredsonite, oc-